AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation June 1980

OUR JUNE 2 MEETING will be show and tell night for the AMRAD 1980 Science Fair Award winners. Dennis M. Blakey, Clyde Fortna, Andre des Rosiers and Steven B. Waltman will be invited to present their entries which won them recognition at area high school science fairs in March. Members are encouraged to bring their families, particularly young teens. The meeting will be at 7:30 p.m. in the Patrick Henry Branch Library, 101 Maple Ave E (Route 123), Vienna, VA. Guests and visitors are welcome.

PERRY WILLIAMS, W1UED, the ARRL's Washington Area Coordinator, has been spending some time talking with people about a digital ham license similar to that issued by the Canadian Department of Communications. The idea would be to petition the FCC to permit computer amateurs to use frequencies in the Amateur Radio Service (say) 220 MHz and up. Applicants would take a digital communications test in place of the normal Morse Code requirements. See Perry's editorial in the June issue of *QST*. If you have any ideas along these lines, please write to Perry, c/o ARRL, 225 Main St, Newington, CT 06111 and please drop a copy to the *AMRAD Newsletter*.

THERE IS SOME INTEREST AT THE FCC in amateur radio experimentation in wideband modulation schemes, or spread spectrum. As a possible type of usage, it might be possible to overlay a new group of users employing spread-spectrum modulation over another group of users who already fully occupy a band of frequencies with narrow-band transmissions. Of course, the present rules do not permit this type of emission in the amateur bands, so a Special Temporary Authority or an Experimental License would be needed. If you would like to experiment with wideband modulation techniques and be part of an AMRAD project, please call Paul Rinaldo, W4RI, 703-356-8918.

WE ARE STILL LOOKING FOR A VOLUNTEER to lay out a printed-circuit board of the AAA1200 modem board featured in the April 1980 issue of the *AMRAD Newsletter*.

Another volunteer is needed to handle the bulk mailing of the newsletter. This is a monthly task that takes about one evening's work per issue. This is best done by someone who is convenient to McLean or Merrifield post offices, either of which will honor our bulk mailing. Please call Paul, W4RI, 703-356-8918, days or evenings.

WE DEEPLY REGRET THE LOSS OF AMSAT PHASE III SATELLITE on May 23 due to failure of one engine in the first stage. The first news came within a couple of minutes after lift off. A French voice speaking English said that the flight was "not nominal". This, of course, was crushing for mission director Jan King, W3GEY, Tom Clark, W3IWI, Joe Kasser, G3ZCZ and others who have devoted many man-years to this project. It is also disappointing to many potential users throughout the world who have reconfigured their shacks to take advantage of the new bird. This bad news was on the heels of the announcement by Perry Klein, W3PK that he would resign, effective June 1. Tom Clark will serve as acting president until the board meets in September. AMSAT's annual meeting will be on September 13, the day befor the Gaithersburg hamfest.

AMRAD Members Are Urged to support AMSAT in every way possible to regain the dream of a Phase III satellite. They will certainly need encouragement, hard work and money to recover from this.

CARF PACKET RADIO MAILINGS are available for $5.00 for the first report and four future reports. AMRAD has ordered a set which will be given to our Protocol column coordinator, Dave Borden, K8MMO. If you are interested in your own copy, write to Packet Radio Mailings, c/o CARF, Box 356, Kingston, Ontario, K7L 4W2 Canada.

AN L-TRONICS DIRECTION FINDER has been ordered for use by our repeater technical committee. The DF set should be in hand by late June. If you are interested in getting involved in DF for the purpose of locating interference to our WB4IWG/R repeater, please contact Jeff Brennan, WB4WLW, 703-354-8541, evenings and weekends.

JOEL NELSON, K4JUM evoked so much interest at our May 5 meeting that he got only half-way through his talk on how to interface with the telephone company. We will schedule him for a return engagement within the next few months.

Meanwhile, if you're really interested in a course on Telephone Interconnect Systems, you should be aware of the July 21-23 running of this course at George Washington University. We're talking about professional interest, with the course fee of $475. If interested in taking this course, write: Continuing Engineering Education, George Washington University, Washington, DC 20052, or phone 202-676-6106 or 800-424-9773.

THE AMRAD LIBRARY NEEDS A NEW HOME upon the departure of Bob Bruninga, WB4APR, sometime in August of this year. It is a collection of amateur radio and computing magazines, books and other items. If you think that you could take on the job of librarian please call Bob on 703-281-2762 eves and weekends. We now have a good selection of literature -- with your help it could become an even greater asset for our membership.

REPORTER(S) ARE NEEDED full- or part-time for professional newsletters in the fields of data and satellite transmission, cable TV, disc/video recording, and radio. Salary will be based on experience and expertise. Contact Stu Crump, WB2RNY at 301-986-0666 during working hours.

INTRODUCTION TO TELEPROCESSING is a 3-day seminar, August 6-8 to be held at the Holiday Inn, 8120 Wisconsin Ave, Bethesda, MD. Major parts of the course include: Introduction to the Teleprocessing Environment, Teleprocessing Equipment, Using Terminal Devices, Communications Software, System Design, and Management and Administration. Write: The American University, Conferences and Workshops, Division of Continuing Education, McKinley Building, Room 256, Washington, DC 20016.

COMPUTER COMMUNICATION SYSTEMS AND NETWORKS is a short course at GWU, August 11-13. This one covers Communication Channels and Signals, Comparison and Evaluation of Communication Channels, The Telephone Network, Data Coding and Encryption, Transmission Protocols, Industry Organization and Regulation, Communication Processors, Communication Software, and Introduction to Networks. Write: Continuing Engineering Education, George Washington University, Washington, DC 20052; call 202-676-6106 or 800-424-9773.

THE COMTRONIX KF-1200 FM TRANSCEIVER has been overlooked by the ham media reports of what was new at the Dayton Hamvention this year. Tom Kikuchi/KA6HXN was quietly displaying this neat little 1296-MHz FM transceiver measuring 2 3/8h x 3 3/8w x 9 7/8d (inches) and weighing 2.6 pounds. It can handle up to 12 crystal-controlled channels within the band 1294 - 1296 MHz or any other 2-MHz segment in the same band. The KF-1200 is to be available in June at a retail price of $499. For data sheets and schematics write Comtronix Inc., 116 Lark Center Dr, Santa Rosa, CA 95401; telephone 707-528-7670.

THE FIRST 5 1/4-INCH WINCHESTER hard-disc drive has been announced by Shugart Technology, 340 El Pueblo Rd, Scotts Valley, CA 95066. Primary features are smaller size (than 8-inch Winnies) and lower cost (unknown at this writing). The only clue on cost is a statement that it has 15 times the capacity of a mini-floppy at less than 3 times the cost. Capacity is 6.38 megabytes, unformatted.

TRADE: Heath HW-10 6-meter AM transceiver, HX-30 6-meter SSB transmitter, HA-20 6-meter linear amplifier; manuals included. Will trade any or all for a Flesher TU-170 or equivalent (RS-232 or TTL-compatible). Will negotiate. Dan Kaminsky, WB4KPP, 6023 N Kings Hwy, Alexandria, VA 22303, phone 703-765-1193.

RADCOM PLUS+^{tm} AMATEUR RADIO COMMUNICATIONS PACKAGE for APPLE owners is being offered by Alex M. Massimo, AF6W, 4041 41st St, San Diego, CA 92105. It consists of a card which plugs into the APPLE II's slot 2 plus software written by Chris Galfo, WB4JMD. It permits transmission and reception of Baudot, ASCII and Morse codes at various speeds. Price is $190.00.

THE MODEL ISO-6 SWITCHABLE ISOLATOR is a new product at $128.95 being sold by Electronic Specialists, Inc., 171 S. Main St, Natick, MA 01760; 617-655-1532. It features spike/surge suppression with 3 individually switched and filtered sockets for a total load capacity of 1875 W maximum. The same firm is introducing a Power Line Interrupter in case ac line voltage is disrupted or exceeds user-selectable limits. It handles up to 15-A resistive or 10-A inductive loads. The PI-15-O/U over/under-voltage model is $142.95; PI-15-U under-voltage only is $127.95.

CREATIVE COMPUTING, PO Box 789-M, Morristown, NJ 07960, has introduced a comprehensive line of educational software for the Commodore PET. They are: Study Made Easy for $14.95 and Conversational Games, also Sensational Simulations for $7.95 each.

MOUNTAIN HARDWARE, INC. is actively seeking quality software products which are ready for marketing. Write Sheri Talbott, VP New Products, 300 Harvey West Blvd, Santa Cruz, CA 95060 or phone 408-429-8600 and ask for Software Information Form.

REAL-TIME AUDIO SPECTRUM ANALYZERS for the Commodore PET, Radio Shack TRS-80 and APPLE II are now available from Eventide Clockworks, Inc., 265 W 54th St, New York, NY 10019, 212-581-9290. The analyzer, used with a home computer, divides the audio frequency spectrum from 20 Hz to 20 kHz into 31 one-third octave bands. The relative amplitudes of these bands, and the input level, are displayed on the computer CRT, either linear or logarithmic. Model THS224 for the PET and the VTU02 for the TRS-80 are $595 each; the AIB232 for the APPLE is $545.

S-100 MULTIFUNCTIONED I/O BOARD with 2 independent sync/async serial ports, 1 strobed 8-bit parallel input port with handshaking, 3 8-bit parallel ports, 3 independent 16-bit timers, and 8-level priority interrupt controller is available from I/O Technology. The price is $375.00. Their address is PO Box 2119, Canyon Country, CA 91351; phone 805-252-7666.

AMRAD WILL HAVE A BOOTH at the Mid-Atlantic Computer Show, Sep 18-21. See full-page ad.

Protocol

David W. Borden, K8MMO
Rt 2, Box 233B
Sterling, VA 22170
703-430-7642 Voice
703-450-5284 Data

Ed. Note: This month's Protocol column is devoted to a letter from Doug Lockhart, VE7APU in reply to one I sent him in February.

1263 Balfour Avenue
Vancouver, B.C.
Canada V6H 1X6
May 5, 1980

Dear Paul:

Thanks very much for your letter of February 26. I apologize for being so slow in responding to it but I was out of town when it arrived.

In your letter you inquired as to the status of the packet radio beacon on 14076 kHz. In fact, at the time you wrote your letter the beacon was on 14074 kHz but at the present time it is on 14076.5 kHz. It was off the air for a while due to this frequency change. I have never read what was written in *HR Report* about the beacon but from rumours I have heard I think the information must have been garbled. I only know that the information did not come through me. In any case, I will describe the beacon:

We are transmitting a bit-encoded ASCII message. If you are familiar with HDLC or SDLC you will know what this means. There are actually six packets sent in each transmission although they are sent back to back. The transmissions occur once every five minutes and are 34 seconds long with a CW call sign of VE7APU in Morse at the end of each transmission. The power is approximately 100 watts into a 3-element beam aimed east from Vancouver. This should put a reasonable signal into your area when propagation conditions are right. The baud rate is 75 baud with a 170 Hz frequency shift so it may be received on the typical RTTY TU. We are interested in propagation reports and are anxious to know if anyone has taken the bother to get an HDLC protocol control chip set up to receive it. To our knowledge, this is the first ever transmission of this type using amateur radio.

You asked about "the Ottawa to Saskatoon packet net." There is no such net in operation. In Canada, at the present time, there are mainly three areas which have set up packet networks on VHF. These are Montreal, Ottawa and Vancouver. We in the Vancouver Amateur Digital Communications Group are the only ones experimenting with HF packet radio communication in Canada at the present time. We plan to increase the speed of the beacon transmissions and have the beacon retransmit received signals in the proper format. Please note that although there are many already experimenting with digital communication on radio, we are experimenting with true packet radio and networking concepts.

Our philosophy is to use state of the art link level protocols and we are not interested in using obsolete start-stop protocols. We are using the Intel 8273 HDLC/SDLC protocol control chip although there are about a dozen others available which will do somewhat the same job. I strongly feel that amateur radio should be able to hold its head up high in the area of digital communications but it will only be a joke if hams continue to use obsolete equipment discontinued by industry. We have the opportunity to bring the level of amateur digital communication equal to or even higher than that of commercial digital communications networks if we take the initiative now. The present state of amateur digital communications technology is twenty years old. We are trying hard to close this disgraceful gap.

I am enclosing *(reproduced below)* some literature of about four months ago which will give you an idea of what we are up to here. Since the article was written we have sold the boards in several areas of Canada and even some in the U.S. although we have not advertised there. The boards are in use on the air and one of them is being used as the beacon. In addition, we can now supply parts for the boards.

One of the gateway nodes will be to a multi-user host computer in Bellingham, WA. We plan to have a direct link to the Seattle area later on this year as well as gateways to the existing RTTY VHF channel and HF links to connect local networks in eastern Canada.

We are using a common channel carrier sense multiple access protocol on VHF. The local network is a "star" network with a

"station" node and multiple "terminal" nodes. Some of the terminal nodes will be connected to host computers, others will be connected to end user terminals and still others will be connected with gateway equipment to other networks and services. We have a lot to do as you can see and this is why the correspondence has suffered. We plan to correct this deficiency by sending out regular information letters.

During the last year or so we have formed some opinions as to the type of standardization of protocols required for creating an amateur radio digital communication network. This is one reason we have designed, built and programmed a communications controller. We are hoping that it becomes a standard so that communications programs may be written everywhere and be interchangeable. If we get a hardware standard of high quality, then the next step is to get a high quality network communications program created. With both of these things going for us, it will be possible to extend the network throughout the continent in a short time. On the other hand, if we do not do something like this, it will be a long time before the network develops.

I don't know whether AMRAD's interests correspond or overlap with our own. We are very flexible on most of our methods with the exception of using the international standard of using bit-encoded data for the data link protocol. All modern commercial data communication networks throughout the world are using this standard as well as many under development at the present time. We are going to use this as well and consider efforts to create a data communication network using obsolete start-stop data link protocols as misdirected.

I am very glad to hear that U.S. hams are now able to use packet radio and have permission to create a communications network. I feel that the requirement to identify on phone or CW every ten minutes is an unnecessary requirement, especially on VHF. Such transmissions do not belong on a data communications channel. I hope that future developments in this area will influence the FCC to drop this requirement.

I would be interested to know what your organization's plans and attitudes toward creation of an amateur radio communications network are. Please write again and tell us.

Good luck in your endeavours!

73,

Doug Lockhart, VE7APU

P.S. *I will send information on the terminal node controller under separate cover.*

D.L.

enclosure →

THE VANCOUVER AMATEUR DIGITAL COMMUNICATIONS GROUP

The Vancouver Amateur Digital Communications Group came into being in January, 1979 and its activities have been increasing since then. It was formed in order to develop equipment and methods to utilize the new wideband digital privileges allowed under the Department of Communications regulations which came into effect on September 30, 1978. One of the major aims of the group is to establish a digital communications network using high-speed packet radio techniques in order to encourage the development of amateur digital communications.

Although the word *amateur* has been used, the members of the working group are well-qualified professionals in the fields of digital and VHF communications, communications software, digital design and other disciplines necessary for the success of the project. The group plans to use *state-of-the-art* techniques wherever possible and to continually improve the technical level and function of the network once it is established. The latter would include the interfacing of the network to a time-sharing computer, a satellite communications channel, and other amateur digital communications systems when these facilities become available.

The decision to strive for state of the art has affected the design of our group's system in many ways. We could have started using start-stop data link protocols, but it was felt that our effort would be better spent in developing a system using bit-oriented protocols. Although we could have got a system going faster and cheaper with the start-stop protocols it would have delayed the implementation of the bit-oriented protocols which we were aiming for. It was also felt that it would create conversion problems for the network users when the new protocols were incorporated. Bit-oriented protocols are much more line efficient than start-stop protocols and are being used in most of the later commercial communications systems (such as DATAPAC). For more information on bit-oriented protocols, you can read Intel's application note on the 8273 Prococol Controller chip (ask for AP-36 which should be available free of charge from your Intel supplier).

At this point, many will be wondering how they can use bit-oriented protocols since they only have equipment which uses either a start-stop serial interface or an 8-bit parallel interface. Our system will use a programmable communications controller (or *black box*) to interface all types of digital equipment to the network. The black box will act like an I/O device to a microcomputer and act like a microcomputer for less intelligent I/O equipment such as terminals, keyboards, printers, modems, teletypewriters, etc. It will be a dedicated function microcomputer in this application and not a general purpose microcomputer. *See another page for further description.*

We felt that the use of a communications controller would solve some major network development problems that would be encountered in the future as well as solving more immediate problems. Some of the advantages of this approach are:

1. Getting equipment to provide bit-oriented protocols - there isn't any available equipment on the surplus market, and none is marketed at a reasonable price.

2. *Not* having to write software for a multitude of equipment and microprocessors as well as the difficulty of maintaining it. The time and effort required for someone to write good software should not be underestimated. It is unreasonable to go through the same effort over and over again for every system in operation now and for new ones yet to be announced.

3. Providing an interface for terminals, teletypewriters, keyboards, printers, etc. to the network. With the black box approach a user does not have to be the owner of a microcomputer which can considerably reduce the cost of entry to the system. Also, the microcomputer owner can keep his system available for other purposes instead of having it tied up running a communication program.

4. Getting standard interfacing and protocols established among the network users. Since everyone would have the same equipment there would be a lot more cooperation

5. Rapid incorporation of changes in the network. In the beginning, the network will undergo a lot of development as we learn more and more about digital communication. A change in network protocol could be simply done by installing a re-burned EPROM in each black box. Think of the problems incorporating a change when there are dozens of different programs running in different equipment on the network.

For the next part of this discussion, a definition of a few terms is in order. A *node* in a data communications network is a point in the network where data is sent to or received from. The network we will be using will support three types of nodes eventually:

•The *terminal* node is the end user interface to the network. It only has to keep track of its own information and follow the protocols of the network. All functions of the network are basically directed at getting data passed from one terminal node to another.

•The *station* node handles the virtual connections between the terminal nodes. All data on the network will pass through at least one station node. The station node provides network services such as routing and access control. It will also provide status information on the network, logging and usage information upon request. Since the station node has to keep track of everyone's data and status and routing information, the program and storage requirements for the station node are larger and more complex than that required for the terminal node.

•The *repeater* node is used to assist communications between station nodes and terminal nodes. It retransmits correctly received packets unmodified to provide missing RF connections. It requires minimal intelligence but must be very reliable since it will probably be located at the top of some mountain. The initial local network here in Vancouver will not need a repeater node because the station node will be well situated. Later, when the geographical area of the local network needs to be extended, repeater nodes will be set up.

I will sometimes use the words station, terminal and repeater when I am referring to a station node, terminal node or repeater node respectively.

RF AND MODULATION SYSTEM

The VADCG wants to develop equipment which will fully utilize the 100 kHz bandwidth allowed by the current *(Canadian)* regulations for packet radio. Unfortunately, none of the equipment manufactured for or used by amateurs is particularly suitable for this purpose. There are usually two problems with most equipment - narrow bandwidth and long switching times between transmit and receive. Most VHF equipment is designed with a bandwidth designed for audio, and this usually limits the top speed to about 2400 baud. The switching time for such equipment is in the order of 100 milliseconds. The group in Ottawa is working with VHF Engineering modes and is using a single pin-diode switching circuit which gives a baud rate of 9600 baud and a switching time of 1 ms.

We believe that a 220-MHz transmitter and receiver could be made up in kit form which would incorporate the special requirements of amateur digital communications. We feel that it could be made cheaply and yet reliably operate at rates greater than 50 kilobaud with switching times of less than 1 ms. We have been conducting preliminary experiments with this in mind and have had very promising results so far. However, we expect it will be several months before we have something developed because we are concentrating on development of the digital interface hardware and software. We have transmitted data with a good *eye* pattern at rates up to 140 kilobaud through a standard consumer FM tuner's 10.7-MHz IF strip under laboratory conditions.

In the meantime, what are we doing to provide local network communication? Well, we are using surplus 202-type modems and operating at the very modest baud rate of 1200 baud. This is an interim solution until the aforementioned 220-MHz equipment becomes available. We are also using the

2-metre band for testing at this low speed. This means that the initial entry for the pioneers can be inexpensive because they can use their existing 2-metre transceiver without modification. The 202-type modem shifts between frequencies of 1200 and 2200 Hz. When and if we run out of surplus modems we will use a modem similar to that of the Montreal group. I understand it does a very good job, and the component cost is only about $30.00. We have not encountered any communication problems at all while using these 202-type modems. In fact, we have been able to record packets directly from a hand-held transceiver onto a portable tape recorder and replay the packets back through the microphone.

The network as planned at the present time would use bit-oriented protocols with VHF or UHF transceivers providing communications channels between the various nodes in the network. All nodes would use the same channel in a time-division multiple-access arrangement. No node would transmit until the channel was clear. Other protocol conventions would assure that the station node has priority over other types of nodes on the channel and prevent any one group of users *hogging* the channel at the expense of others.

VADCG PACKET RADIO NETWORK PROTOCOL

While I was trying to design a suitable PR protocol, it was suggested, several times, that an amateur PR network should use an existing commercial protocol, specifically the X.25 standard used by DATAPAC and other packet networks. Unfortunately, at the frame-level this is a point-to-point, full-duplex protocol. A multipoint, half-duplex frame-level protocol is required for communicating over a common radio channel with many terminals.

If the X.25 frame-level protocol is no good, what about the X.25 packet-level protocol? Well, it is possible to incorporate the packet-level protocol in the terminal, but the program memory in the terminal would have to be much larger. The fact is that many of the standards in the X.25 protocol either are concerned with the specific environment of the telephone company or with routing and flow control which are the responsibility of the station and not the terminal. Also, most of the functions required by an amateur packet radio network are not defined in the X.25 protocol.

I feel that we will only need the X.25 protocol when we need to interface the network to an existing communications system using the X.25 standards. At that time, the conversion could be done in a *gateway* node on the system. A gateway is a node which converts protocols on one type of network to those protocols used on another network. The result is that all users on both networks can communicate with another in spite of significant differences in protocols. They all appear to be on one larger network.

Enough talk of X.25 protocols; let's talk about the VADCG protocol. It is a bit-oriented protocol and bears many similarities to other bit-oriented protocols. In fact, current industry standards were used as much as possible in its design. The basic packet format is shown in the following diagram:

2	1	1	1	1	n	2	1
SYNC	F	A	C	PH	INFORMATION	FCS	F

SYNC = Preframe synchronization
F = Flag
A = Terminal address
C = Control
PH = Packet header
FCS = Frame check sequence

SYNC: This field is used for synchronizing the receiving equipment before sending the flag following. It is only used for the first packet in a group of packets. It is 16 bits of alternating zeros and ones to give a maximum number of transitions for synchronization.

FLAG: A special 8-bit character with the binary pattern of 01111110 or 7E in hexadecimal. It marks the beginning and end of the packet. If another packet is sent immediately after this packet, then the second packet may use the ending flag of the first packet as its beginning flag.

ADDRESS: This is an 8-byte field with the address of the terminal or repeater that this packet is coming from or going to. An address of FF (hexadecimal) is used as a broadcast address and an address of 00 is used before the terminal is signed on the network. The other 254 addresses will be used for local terminal addresses. These addresses are dynamically assigned by the station at sign-on time and may be reused by another terminal after the previous user has signed off. This address field may be extended when we require more than 254 users simultaneously signed on to a station. Note that this does not mean that the network is limited to 254 simultaneous users since eventually there will be several stations in the network. The higher level network addressing will be done by the stations and will be transparent to the terminals. In fact, all network addressing is transparent to the terminal user, who only works with network *names* or call-signs.

CONTROL: This is an 8-bit field which describes the type of packet this is. It also contains acknowledgment information which ensures that no packets are missed or processed out of order. The protocol allows a maximum of seven packets to be transferred across the link before an acknowledgment is required. It will handle partial acknowledgments.

PH: Packet Header - This is a one-byte field which, for the time being, will be

used to control whether the terminal is sending to the network services or to another terminal. It will be an ASCII blank (20 hexadecimal) when the packet is for another terminal and non-blank for communication with network services.

INFORMATION: This field contains a variable number of bytes of data. In certain supervisory packets it will not be present.

FCS: This Frame Check Sequence ensures that no bits are incorrect in the packet. It is 16 bits long.

TERMINAL NODE CONTROLLER DESCRIPTION

(Note that the term, *terminal node* refers to the end users of the network, typically the *ham* with a VHF transceiver, terminal controller, and a teletypewriter or microcomputer.)

The terminal Node Communications controller has been built to interface the network user's digital equipment (teletypewriter, microcomputer, etc.) to his VHF transceiver. It will accept data from the digital equipment, convert it into packets (or frames) and actuate the transmitter to send the packet into the network. Likewise, it will receive packets from the receiver intended for the Terminal Node and pass the data from the packet to the user's digital equipment. It will handle all the bit-oriented protocols required by the communications link and all the network protocol as well as any ASCII - Baudot conversions or other code conversions as required.

The controller was designed to be as flexible as possible and be adaptable to all future requirements of the network. Flexibility is built in by having all functions under software control with the program in reprogrammable EPROM's. Any changes in network protocol or a change in the user's digital equipment may be quickly compensated for by substituting one EPROM for another. The controller will handle either serial or parallel devices with full handshaking lines provided for. The serial baud rate, number of stop bits, number of data bits, and parity requirements are all under software control. Even the choice of EIA levels, TTL levels or 20-mA current loop signals on the serial interface has been provided for. The connector for the digital equipment is a DB-25S with standard wiring for the immediate hookup of a computer terminal but with the proper cable connections may be interfaced to practically any digital equipment. Here are some examples: ASCII or Baudot teletypewriters, computer terminals, modems and microcomputer serial or parallel I/O ports.

This flexibility extends to the transceiver side of the controller where standard baud rates from 600 baud to 38.4 kilobaud are supported. The connector is a DB-25S with wiring to connect to a standard modem. A dip switch for selection of asynchronous or self-clocking modems is provided. Lines for control of the transceiver control are also present on the connector. Since the data rate and the type of modulation used are subject to change, the modem will be separate from the digital part of the interface (although it may be used in the same cabinet which will have room for the power supply as well).

TERMINAL NODE CONTROLLER SPECIFICATIONS

DIGITAL EQUIPMENT INTERFACE:

CONNECTOR - DB-25S; SIGNAL LEVELS - Selectable between TTL, EIA RS-232 or 20-mA current loop for serial interface, TTL levels for parallel interface; WIRING - Standard for EIA cable to modem, dip jumper provided for non-standard connections; BAUD RATES - All baud rates programmable from dc to 56k baud; SERIAL INTERFACE - Asynchronous with 5, 6, 7, or 8 bit characters, even, odd or no-parity bit generation and detection, 1, 1.5 or 2 stop bit generation, full double buffering, prioritized interrupts under software control, all modem control signals provided (CTS, RTS, DSR, DTR, RI and Carrier Detect), false start bit detection, line break generation and detection, interface status readable by software; PARALLEL INTERFACE - Fully buffered, programmable, bidirectional interface or separate 8-line input and output, programmable interrupt controls;

TRANSCEIVER/MODEM INTERFACE:

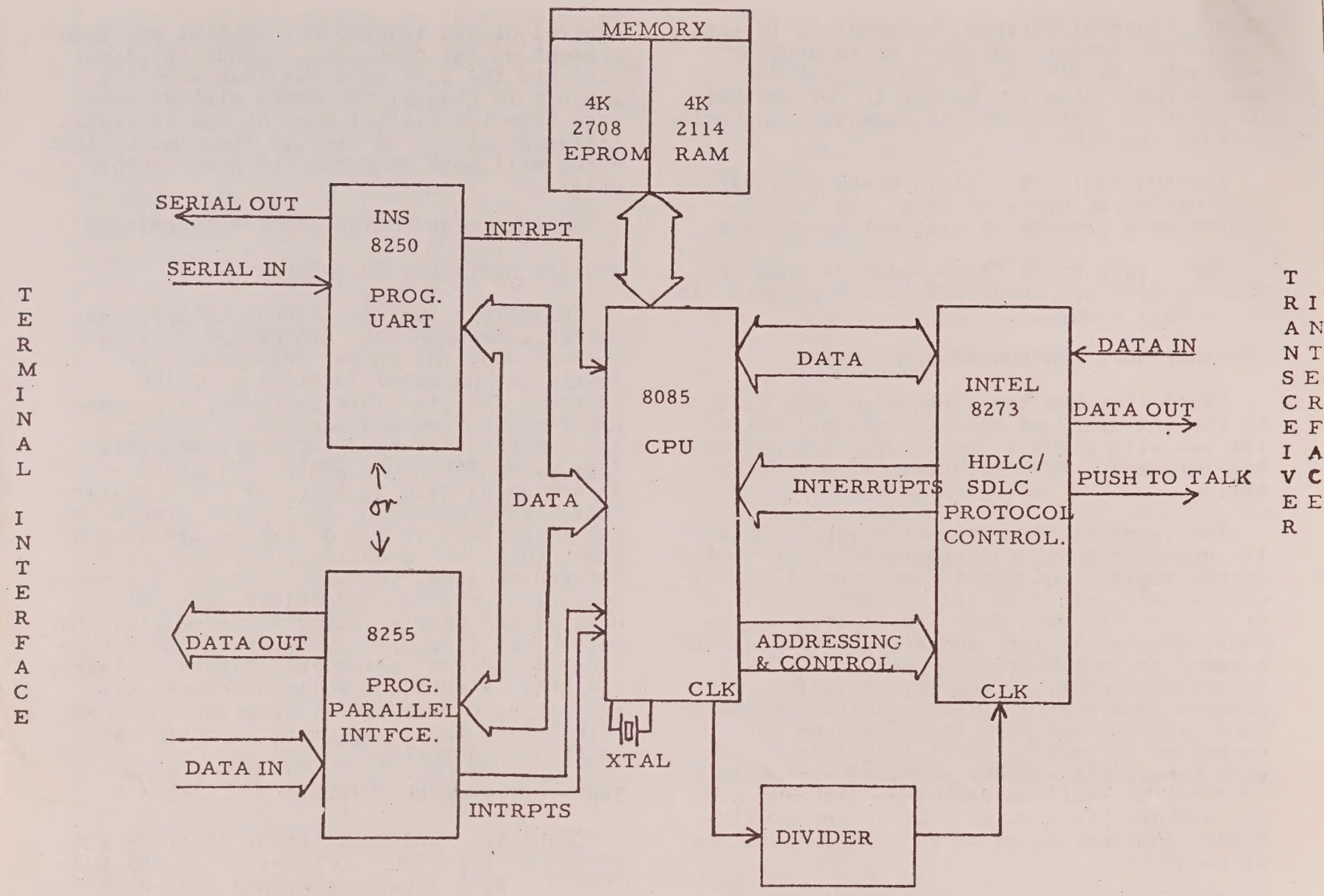
CONNECTOR - DB-25S; SIGNAL LEVELS - EIA RS-232 or TTL with dip jumpers; MODEMS SUPPORTED - Both asynchronous and self-clocking with dip switch selection; BAUD RATES - dip-switch selectable from the following: 600, 1200, 2400, 4800, 9600, 19200 and 38400 baud; DATALINK PROTOCOL - Either SDLC or HDLC or other bit-oriented protocols, either full or half duplex; SIGNALS SUPPORTED - Modem control signals (CTS, CD, RTS, DSR, DTR), Receive and transmit timing for synchronous modems (RT, TT), Lines to control the transceiver, NRZI or non-NRZI data supported; INTERRUPTS - Both data transfers and status information is passed under interrupt control;

CPU - Intel 8085; MEMORY - Up to 4k EPROM (2708) and 4k RAM (2114); DATA LINK CONTROLLER - Intel 8273; SERIAL I/O - National INS8250; PARALLEL I/O - Intel 8255;

POWER SUPPLY - Off board providing +5V and +12V; POWER REQUIREMENTS - 120 volts ac, 60 Hz; COOLING FAN - not required;

BOARD - 7.75 x 8.5 inches (18.4 x 21.6 cm) made of double-sided G-10 glass epoxy material using plated-through holes.

PRICE - $30.00 for the board only. The VADCG will be organizing group purchases of components at a future time. Quantities of the first run of boards are limited. To order a board or to get more information write to: VADCG, 1263 Balfour Ave,



VADCG PROGRAMMABLE COMMUNICATIONS INTERFACE

Vancouver, BC, Canada V6H 1X6 or telephone (604) 738-5683.

STATION NODE SOFTWARE

The program to run in the station has been under development for several months and is finally complete and working OK now. As written at the present time, the program supports a star network, i.e., a network consisting of one station and a number of terminals. Support for repeaters and multiple station networks will be written when required.

The program supports the network protocol as outlined in another area. The network service commands supported at the present time are:

1. CONNECT call-sign. Asks network services to establish a virtual connection between your terminal and another terminal.

2. DISCONNECT. Asks network services to break the connection established between your terminal and another terminal.

3. LIST. Asks network services to send to your terminal a list of all terminals at present signed on to the network. The list indicates the network address, call-sign, call-sign of any connected terminal and status of every terminal.

4. SIGNOFF. Asks network services to break any connections with other terminals and to remove your terminal from the set of terminals signed on to the network. It frees any network resources that your terminal may be using.

These four terminal commands provide the basic commands required for inter-terminal communication. The system is in a state of rapid development and more commands and functions will be added to the network as soon as possible.

TERMINAL NODE SOFTWARE

There are two separate and distinct programs running in the terminal controller. One program contains the network protocol required for the terminal to communicate

with the network. It drives the 8273 HDLC/SDLC protocol controller chip and switches the transceiver between transmit and receive. I call it the Line Interface Program (or LIP).

The LIP will pass correctly received packet data for this terminal to the TIP in correct sequence and will accept data from the TIP for incorporation into packets and will ensure that they get passed to the station. This program has been written and occupies two of the four EPROMS in the controller. Actually, there is a lot of extra room for expansion in the second EPROM. Every terminal uses the same LIP because all terminals must use the same protocol (speak the same language). The LIP will drive the 8273 to its maximum speed. When the network protocol needs to be changed to incorporate improvements, it is intended that the two old LIP EPROM's be exchanged for two new EPROM's with the new program burned in them.

The other two EPROM's contain the TIP. The TIP's job is to accept data from the digital equipment at the terminal location and build it into blocks to pass to the LIP. It also accepts blocks of data from the LIP and passes them to the digital equipment. It is the *personality* module for the terminal. Each terminal will use a different TIP because each user will have different digital equipment. For example, a network user may have a Model 15 Teletype*tm* which he wants to use on the network. The Model 15 runs at 45.45 baud and uses the Baudot code. His TIP would initialize the serial interface on the serial interface on the controller to run at 45.45 baud with 1.5 stop bits and 5 data bits. His TIP would also likely translate the Baudot code into ASCII to be sent out on the network and translate the ASCII code from the network to Baudot to be sent to the Model 15. His TIP would also have a field containing his call-sign and other information used when signing on to the network. Since the Model 15 is a *dumb* terminal, the TIP could also be written to give the Model 15 some *intelligence*. His TIP would be substantially different from that of another user who, for instance, had a 9600-baud ASCII video terminal or from a TIP for a TRS-80 microcomputer.

The TIP and LIP will use a simple software protocol to communicate with one another. Both of these programs are basically interrupt driven after initialization and generally operate independently from one another. This makes the software easy to write.

As you might imagine, this ambitious project requires a lot of work and some money. At present our funding is coming from individual donations but is not sufficient to meet our needs for the immediate future. For a $10 donation we will mail an extensive information package with circuit diagrams and component information for all the boards. You will also get progress reports and newsletters periodically. Our mailing address is: VADCG, 1263 Balfour Ave, Vancouver, BC, Canada V6H 1X6.

We hope that someday you will be able to sit down in your ham shack with your terminal connected through the interface to your low-power VHF transceiver and ask the network to connect you with (for example) VK3XXX in Sidney, Australia and almost immediately get the message back on your screen: "Connection with VK3XXX established - begin communication". *AMRAD Newsletter*

THE VALLEY COMPUTER CLUB, Burbank, CA, has its public domain software distribution computer system up and running. The club is supporting 2 on-line software exchange systems for its members. The numbers to call to gain access to the system are:

805-527-9355 Mike Karas, Sysop
805-527-9321 Kelly Smith, Sysop

Modems are 8 data bits, 2 stop bits, no parity, auto-answer/auto-disconnect. After calling either system, callers should use the MODEM.COM program from the CP/M Users Group-Vol 25.11 to take advantage of the file-transfer capabilities of the systems. Using the MODEM program, type MODEM T <CR> to go into the terminal mode. About 30 seconds after placing the call, the exchange system will sign on as follows:

```
WELCOME  TO THE VALLEY COMPUTER CLUB
    + SOFTWARE EXCHANGE SYSTEM +
>>>PUBLIC DOMAIN SOFTWARE FEATURED<<<
      "Software of the Week"
-----------------------------------
>PLEASE ENTER YOUR VCC IDENTIFICATION CODE<
```

Incorrect identification causes the system to say "SORRY TURKEY, NO MATCH ON YOUR IDENTIFICATION! +++ DISCONNECT +++. If it finds the correct match on your ID code, it will respond:

```
  HELLO, JOHN Q.VCC PUBLIC
  YOU NOW HAVE CONTROL OF THE SYSTEM,
A>
```

You now have absolute control of the system. Now, if you like, you may TYPE a file of interest to you, for example: TYPE STARTREK.ASC <CR>, whereupon the ASCII source listing of the file STARTREK will appear on your screen. Control S can be used to start/stop the print. Or, a page at a time may be asked for by typing READ STARTREK.ASC<CR> for the first page and any keyboard character for others. There are additional commands to determine if you have room on your disc to receive the file and to send the file to yourself, plus some special control characters.

VCC's address is PO Box 6545, Burbank, CA 91510. Thanks, *VCC Newsletter*.

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Four hundred booths and 100,000 square feet of floor space for each of the three shows may sound big, and it is. But over half that space has already been sold, mostly to last year's participants. (Several companies tried single booths last year and are back again with reservations for 12 to 16 booths!) So hurry. Call Bill Mahan or Joan Donahue at (617) 524-4547 to get more facts and assure your reservation.

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BOSTON: Hynes Auditorium/Prudential Center, Thu., Nov. 20 thru Sun., Nov. 23.

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THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of over 250 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD NEWSLETTER*. Except for the annual meeting in December, meetings are normally reserved for technical talks on computer or radio subjects.

THE WD4IWG/R REPEATER is an open repeater for data communications, voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent area coverage. It features a semi-private autopatch available to members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The repeater trustee and head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is a monthly publication which is mailed to all AMRAD members, editors of club newsletters which reciprocate and others. Technical articles, new product announcements, product evaluations, news items, calls for papers and other copy related to amateur radio and computers are welcome. Classified ads are free to members. Commercial advertisement inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. All items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the *AMRAD NEWSLETTER* is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Inquire for overseas rates.

THE AMRAD MESSAGE SYSTEM is an AMI 6800 computer bulletin board system accessible by telephone on 703-281-2125. It is compatible with originate modems in the Bell 103/113 series used in many terminals and personal computers. It automatically adjusts to either 110 or 300 baud speed upon receipt of several RETURNs when you sign on. From there it is self teaching. A sister system, VIRGINIA TTY, may be used by those with deaf TTYs by calling 703-281-1214. A handicapped educational exchange (HEX) is also operated by AMRAD. For details on any of these systems, please contact Bob Bruninga, WB4APR, 907 Ninovan Rd, Vienna, VA 22180; call him on the repeater or phone 703-281-2762.

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AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio (FAR), the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC). AMRAD publishes a monthly column in the FAR magazine, *Auto-Call*.

TRAINING CLASSES on amateur radio and computing are run as needed by the membership. Please discuss your training requirements with any Director.

SPECIAL INTEREST GROUPS may be formed from time to time. If you are interested in joinging or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015, phone 703-323-8345.

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